December 1972

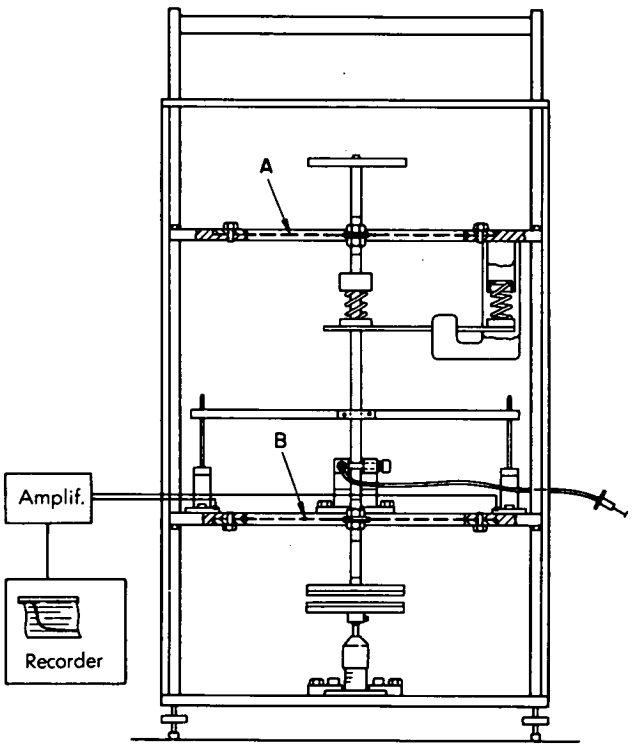
B72-10700

NASA TECH BRIEF

NASA Pasadena Office

Parallel-Plate Viscometer

The parallel-plate viscometer subjects the test sample only to shear stress; as a result, it is possible to compute theoretical absolute viscosities from experimental data. To measure viscosity by the parallel-plate method, a weighted optical flat is allowed to drop parallel toward another optical flat on which is supported the sample, and the deceleration curve of the weighted flat is recorded; the viscosity can be computed from the deceleration curve, but it is necessary to assure that the optical flats remain parallel throughout the test and that the weighted flat falls relatively friction-free and without movement to the side.



The parallel-plate viscometer shown in the diagram consists essentially of a movable vertical rod with an optical flat fixed to its lower end and centered over another optical flat which is held rigidly parallel to the movable flat. The two perforated diaphragms of thin metal, marked A and B in the diagram, constitute an important feature of the viscometer, for they provide virtually no resistance to a limited amount of vertical movement of the rod carrying the movable flat, but they strongly resist any lateral movement and thus serve to keep the movable optical flat centered and parallel to the stationary flat. The upper part of the movable rod is fitted with a platform, and a counter-balance spring system compensates for the mass of the movable assembly so that only the weights placed on the platform determine the pressure exerted by the movable optical flat against the other flat. The vertical rod is provided with a spring-loaded lock which prevents movement of the vertical rod; the lock can be tripped by a camera-shutter release cable.

A horizontal bar attached to the vertical rod carries the probes for two linear variable differential transformers (LVDT); these devices are frictionless and they convert linear motion into a proportional, stepless output signal. Signals from each LVDT are processed and sent to a recording oscillograph to provide deceleration curves of the falling flat; a double trace is recorded by the oscillograph, and any variation between traces indicates that the vertical rod has been displaced laterally, such as may occur when a sample has a very high viscosity.

(continued overleaf)

Computation of absolute viscosity is based on a formula for incompressible Newtonian viscous liquids which involves the velocity of fall of the upper flat for any time interval, the volume of sample, and the weight on the platform.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Reference: TSP 72-10700

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,706,221). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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under contract to
NASA Pasadena Office
(NPO-11387)